

EXHIBIT 4

A33 – A88

08/967826	32	Subclass
12/27	22	Class
12/27	22	Issue Classification

6409840

UTILITY SERIAL NUMBER	PATENT DATE		PATENT NUMBER	
	JUN 25 2002		6409840	
SERIAL NUMBER 08/967,826	FILING DATE 11/12/97	CLASS 428	SUBCLASS 132,000	GROUP ART UNIT 2892
ROLE 66				

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CONTINUING DATA*
VERIFIED THIS APPLN IS A DIV OF 08/374,843 04/27/95 PAT 5,714,600
WHICH IS A 371 OF PCT/AU93/00029 07/30/93

[Signature]

FOREIGN APPLICATIONS*
VERIFIED JAPAN PL 3894 07/31/92
JAPAN PL 7266 02/12/93

[Signature]

Foreign priority claimed 35 USC 119 conditions met	<input checked="" type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no	AS FILED	STATE OR COUNTRY	Sheets DRAWGS.	TOTAL CLAIMS	INDEP. CLAIMS	FILING FEE RECEIVED	ATTORNEY'S DOCKET NO.
Verified and Acknowledged	<i>[Signature]</i>		→	GLX	4	8	2	\$790.00	1453-0028
ADDRESS	LUCILLE PRITZ LEGLAW & BECKER 27 CANAL CENTER PLAZA SUITE 22014 ALEXANDRIA VA 22314 <p><i>McDERMOTT WILL & EMERY</i> <i>600 13TH Street N.W.</i> <i>Washington DC 20006</i></p>								

TITLE		HIGH AMYLOSE STARCH AND RESISTANT STARCH FRACTION							
		U.S. DEPT. OF COMM./PAT. & TM—PTO-436L (Rev. 12-92)							
PARTS OF APPLICATION FILED SEPARATELY		3/26/02 3/26/02 Assistant Examiner DAVID BRUNGBECK PRIMARY EXAMINER GROUP 1100 Primary Examiner PREPARED FOR ISSUE							
NOTICE OF ALLOWANCE MAILED		Applications Examiner CLAIMS ALLOWED Total Claims 5 Print Claim 1							
ISSUE FEE		DRAWING Sheets Drawg. 4 Figs. Drawg. 4 Print Fig. none							
Amount Due	Date Paid	ISSUE BATCH NUMBER							
\$4930.00	5-13-02								
Label Area		WARNING: The information disclosed herein may be restricted. Unauthorized disclosure may be prohibited by the United States Code Title 35, Sections 122, 181 and 368. Possession outside the U.S. Patent & Trademark Office is restricted to authorized employees and contractors only.							

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PATENT APPLICATION

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Mailed**CONTENTS**

1. Application	4	papers.
2. Pre-Amat A		11-12-97
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10. Format		
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12. Office Address		2-11-99
10/9	Notice	10/9/01
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15. Response		2/8/02
9/24	Allowance	2-26-02 m/s
5-10/20	Formal Drawings (L) shg set	5-13-02
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SEARCHED

Class	Sub.	Date	Exmr.
127	36		
536	102	4/19/98	NM
120	226-1		

SEARCH NOTES

	Date	Exmr.
checked present US PAT 5741602	2/24/02	recd

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.
12-7	32		
53C	132	4/19/97	Alm
13C	202-1		

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POSITION	ID NO.	DATE
CLASSIFIER	21	12/98
EXAMINER		
TYPIST		
VERIFIER		
CORPS CORR.		
SPEC. HAND		
FILE MAINT.		
DRAFTING		

INDEX OF CLAIMS

Claim	Date
Final	Original
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PATENT APPLICATION SERIAL NO. 11/12/97

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
fee record sheet

01/21/1998 MCARDLE 00000016 DAW:122237 08967826
01 FC:101 790.00 CH

TO-1556
(5/87)

WO 94/03049

PCT/AU93/00389

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HIGH AMYLOSE STARCH AND
RESISTANT STARCH FRACTIONS

Technical Field

This invention relates to high amylose content starch, in particular to a maize starch having an amylose content of more than 80% w/w. The invention further relates to single, double and multiple cross maize hybrids, particularly to a maize single cross F1 hybrid, capable of producing grain having such a high amylose content and to this grain.

The invention still further relates to fractions of high amylose starch that are enriched in dietary fibre and resistant starch content whilst claiming a high amylose content.

Background Art

Most common starches contain approximately 25% amylose and 75% amylopectin. Amylose is a linear glucose polymer fraction, whilst amylopectin is a branched glucose polymer fraction.

In the prior art, it has been recognized that currently available commercial starch having an elevated amylose content would impart certain desirable properties to various compositions including films, foods and industrial products. Accordingly, attempts have been made in the prior art to produce high amylose content maize. This is exemplified in AU-A-45616/89 wherein a maize seed deposited as ATCC No. 40499 is disclosed as capable of yielding a starch having an amylose content of up to 72%.

Typically, however, a commercial starch having an amylose content of 55-65% would be regarded in the art as having a high amylose content.

The present inventors whilst recognizing the utility of the commercially available so-called high amylose starches, have sought to produce a maize having a still higher amylose content.

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Disclosure of Invention

In the course of a breeding program, a single cross F1 hybrid maize seed was produced, which carried the ae amylose extender gene. This seed was found to be capable 5 of producing grain, in which the amylose content of the starch derived therefrom was in excess of 80%.

Accordingly, in a first aspect, this invention consists in a hybrid maize seed capable of producing a starch having an amylose content of more than 80%.

10 In a second aspect, this invention further consists in a maize starch having an amylose content of more than 80%, physically or chemically modified derivatives thereof, and destructureized and non-structureized forms thereof.

15 In a third aspect, this invention still further consists in compositions including a maize starch selected from the group consisting of maize starch having an amylose content of more than 80%, physically or chemically modified derivatives thereof and destructureized and 20 non-structureized forms thereof.

In a fourth aspect, this invention still further consists in a process for the formation of a composition comprising including a maize starch selected from the group consisting of maize starch having an amylose content 25 of more than 80%, physically or chemically modified derivatives thereof and destructureized and non-structureized forms thereof, in said composition.

30 In a fifth aspect, the present invention still further consists in a hybrid maize seed resulting from a cross between any of the parental lines selected from the group consisting of G112, G113, G116, G117, G118, G119W, G120, G121, G122, G125W, G126, G128, G129, G135W, G136W, G138W, G139W, G140W and G144, said hybrid maize seed yielding a starch having an amylose content of more than 35 80%.

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Starch granules from any botanical source are a heterogeneous mixture varying in physiological age and this affects their physical size, structure and properties. If the starch granules are physically separated according to their granule size, it has been noted by a number of authors that the properties of each size fraction are somewhat different. For example, Cluskey et al in Starke, 32, 105-109(1980) reported on the fractionation of dent corn and amylo maize starch granules. They found that an inverse relationship existed between granule size and iodine binding capacity in the amylo maize. Thus, the percent apparent amylose found in the fractions of amylose V starch amounted to 40% for the largest size particles and 52% for the smallest particles.

The correlation between amylose content and size fraction has been observed by the present inventors in relation to high amylose starches of the type mentioned above and in co-pending patent application PL6537.

In this latter mentioned patent application, PL6537, it was disclosed that high amylose starches have a high dietary fibre or resistant starch content. More specifically, it was found that there was a correlation between amylose content and dietary fibre/resistant starch such that increasing levels of amylose above 55% were associated with increasing levels of dietary fibre/resistant starch.

Patent application PL6537 further disclosed the useful nature of such starches in the preparation of food compositions having an enhanced dietary or resistant starch content.

Based on the observations of
(1) an association of dietary fibre and resistant starch with increasing levels of amylose; and
(2) increasing amylose content with decreasing starch granule size,

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it was to be expected that decreasing starch granule size fractions of high amylose starch would be associated with enhanced levels of dietary fibre and resistant starch.

Surprisingly, this was found to be incorrect. In fact it was found that there is an optimum starch granule size fraction which is intermediate in size and not necessarily associated with the highest amylose content fraction.

Accordingly in a sixth aspect, the present invention still further consists in a starch fraction of enhanced dietary fibre and/or resistant starch content comprising a high amylose starch which has been fractionated according to granule size to yield a fraction which is characterised by a dietary fibre and/or resistant starch content which is greater than said high amylose starch.

In a seventh aspect, the present invention still further consists in a food composition having an enhanced dietary fibre and/or resistant starch content, including a starch fraction of enhanced dietary fibre and/or resistant starch content derived from a high amylose starch which has been fractionated according to granule size to yield a fraction which is characterised by a dietary fibre and/or resistant starch content which is greater than said high amylose starch.

For the purpose of the description of this invention, "high amylose" means an amylose content (dsb) of 50% or more, preferably 70% or more, most preferably 80% or more. Particularly preferred amylose contents are 85% or more and 90% or more.

For the purposes of the description of the invention, the method by which amylose was determined is set out below.

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METHOD: Apparent Amylose (Blue Value)**SCOPE:** High Amylose Maize Starch**APPARATUS:**

Defatting

- 5 Soxhlet extraction apparatus
 Steam bath
 Whatman thimbles, 25 x 80mm
 Drying Oven 105°C
 Desiccator

10 Amylose Determination

- Stoppered 50ml test tubes
 Vortex mixer
 Boiling water bath
 Spectrophotometer (605mm, slit width 0.2mm)

15 **REAGENTS:**

Defatting

- Methanol (AR Grade)

Amylose Determination

- Dimethylsulfoxide (HPLC Grade)

20 Iodine/Potassium iodide solution

- 3.0g iodine and 30g potassium iodide made
 up to 1000mls with 0.1N sodium hydroxide

- Methanol (AR Grade)

- Amylose (Sigma Cat. No A0512)

25 Dried for 2 hours at 105°C prior to use.

PROCEDURE:

Defatting

- (1) Weigh 5 grams of starch into the thimble.

- (2) Place the thimble in the Soxhlet apparatus.

30 (3) Extract the sample with methanol (200mls) for
 20 hours

- (4) Recover the thimble and dry in an oven at
 105°C for 12 hours.

Amylose Determination

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- (1) Accurately weigh starch (100.0 to 105.0mg) into the test tube.
- (2) Add methanol (1ml) and vortex mix.
- (3) Add DMSO (15mls), invert the test tube, and vortex mix.
- 5 (4) Place the test tubes in a vigorously boiling water bath for 60 minutes.
- (5) Invert and vortex mix each test tube at 15 minute intervals during this period.
- 10 (6) Add distilled water (15mls), invert and vortex mix. Place the test tube in the boiling water bath for a further 30 minutes.
- (7) Quantitatively transfer the contents of the test tube to a 100ml volumetric flask (use a funnel in the flask). Make the solution to volume with distilled water.
- 15 (8) Transfer an aliquot (3mls) of this solution to a 100ml volumetric flask and add 90mls of distilled water.
- 20 (9) Add Iodine/Potassium Iodide solution (1ml) to the diluted solution and immediately shake and mix thoroughly. Make to volume with distilled water.
- (10) Measure the absorbance of this solution at 605 nm compared to a blank consisting of Iodine/
- 25 Potassium Iodide solution (1ml) diluted to 100mls with distilled water in a volumetric flask.

CALCULATIONS:

For native starches:

$$30 \quad \frac{\text{Absorbance} \times 13}{\text{wt. sample dsb}} = \text{_____}$$

* dsb = dry solids basis.

The method by which starch was separated from the
35 maize grain was as follows:-

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1. Prepare 200g meal by grinding through the 2mm then the 1mm screen of the Retsch Mill.
2. Wet thoroughly, stirring by hand, with 600ml 0.1N NaOH.
3. Add 2,200ml 0.1N NaOH and blend 5 minutes at 2/3 speed with the Ultra Turrax.
4. Sieve over 44μ screen.
5. Return sieve overs with 1L water and blend for another 3 minutes, if necessary.
6. Sieve over 44μ screen.
- 10 7. Centrifuge filtrate at 3000 rpm for 15 minutes. Decant. Wipe out the neck of the bottle with a tissue to remove fat.
8. Reslurry starch (centrifugate) with 200ml water, i.e. 50ml in each of 4 tubes. Centrifuge.
- 15 9. Remove starch from centrifuge tubes with about 250ml water.
10. Adjust pH of starch slurry to 6.0-6.5 with 0.5N HCl. Filter again over 44μ screen, if necessary.
11. Buchner filter and air dry.
- 20 Modes for Carrying out the Invention

In order to better understand the nature of this invention, a number of examples will be described.

Brief Description of Drawings

Fig. 1 is a gel permeation chromatography molecular weight profile of a number of maize starches;

Fig. 2 is a viscopgraph of a number of maize starches in water;

Fig. 3 is a viscopgraph of a number of maize starches in base; and

30 Fig. 4 is a graph of total dietary fibre versus average starch granule size.

Maize Seed

A range of parental lines of maize seeds were obtained from High Yield Seed Co, Tamworth, Australia.

35 Non-limiting examples of these parenting lines included

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G112, G113, G116, G117, G118, G119W, G120, G121, G122, G125W, G126, G128, G129, G135W, G136W, G138W, G139W, G140W and G144.

Hybrids were produced by crossing inbred lines
5 carrying the as amylose extender genes. These inbred lines were selected for combining ability and identified as specific female and male parents to produce the hybrids. Conventional breeding methods and techniques were used in developing inbred lines with repetitive
10 amylose assays to ensure the transfer of recessively inherited as gene.

One particular cross between male G116 and female G121 resulted in a F1 hybrid, referred to as Code 008 and deposited with the American Type Culture Collection

15 (ATCC), 12301 Parklawn Drive, Rockville, MD20853, U.S.A., under the designation 75182 on 15 January 1992. This hybrid yielded grain the starch of which was found to have an amylose content in excess of 80%.

Based on the disclosure of this invention, the person
20 skilled in the art would expect that hybrids resulting from further crosses of the parental lines mentioned above will yield starch having an amylose content in excess of 80%.

In fact experimental hybrids have yielded starches
25 obtained from crosses between the above mentioned parent lines having high amylose contents. Set out below is a summary of the relevant crosses with amylose content in % bracketed.

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	<u>FEMALE</u>	<u>MALE</u>	<u>HYBRID</u>
	1. G117 (81.6)	G116 (82.2)	G117 x G116 (83.3)
	2. G116 (82.2)	G122 (89.6)	G116 x G122 (80.5)
	3. G118 (94.3)	G122 (89.6)	G118 x G122 (85.9)
5	4. G120 (94.6)	G122 (89.6)	G120 x G122 (80.4)
	5. G122 (89.6)	G120 (94.6)	G122 x G120 (81.9)
	6. G122 (89.6)	G140 (92.2)	G122 x G140 (85.4)
	7. G128 (71.5)	G129 (61.8)	G128 x G129 (82.8)
	8. G140 (93.2)	G121 (94.7)	G140 x G121 (93.0)
10	9. G140 (92.2)	G144 (60.4)	G140 x G144 (85.3)
	* 10. G139W (71.9)	G136W (93.4)	G139W x G136W (95.7)
	11. G121 (94.7)	G126 (82.2)	G121 x G116 (85.0)

* W = White seed.

15

Experiments conducted using Code 008 seed have shown that the climatic and agronomic conditions under which the maize is grown will have a significant effect on the amylose content. Specifically, it has been found that seed cultivated under irrigation near Tamworth, Australia (latitude 31.1°S) in an early crop and a late crop yielded starch having an amylose content respectively of 85.0% and 90.1%. Similarly, a crop cultivated at Finley, Australia (latitude 35.6°S) yielded starch having an amylose content of 94.8%. By contrast, the same seed when cultivated under irrigation at Giru, Australia (latitude 19.5°) yielded a starch having an amylose content of 78.6%.

Accordingly, a preferred embodiment of this invention comprises a maize seed deposited with the ATCC and designated 75182.

A further preferred embodiment of this invention comprises a maize starch having an amylose content of 85.0% or more, most preferably 90.1% or more.

To further characterize the maize starch derived from Code 008 grain, molecular weight profiling by gel

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permeation chromatography has been performed. The method by which this was done is set out below whilst the results are shown in the accompanying Figure 1. For comparative purposes, two commercially available maize starches, HA

5 Class V and HA Class VII are shown.

METHOD: Gel Permeation Chromatography of Starch

SCOPE: Starch

APPARATUS:

100
Sample Preparation

- 10 Screw capped test tubes (50ml)
- Boiling water bath
- Microcentrifuge (Eppendorf 5415)
- Desiccator

HPLC

- 15 Column Alltech GPC High MW Polar 5U
 (Cat. No. 100586)
- Detector Waters 410 Refractive Index
 Detector (X 128 35°C)
- 20 Pump Waters 600 E
- Injector Waters 712 WISP
- Column Heater Set at 25°C
- Software Maxima 825 (V 3.3)

REAGENTS:

- 25 Dimethyl sulfoxide (Chrom AR HPLC Grade -
 Mallinckrodt)
- Dimethyl formamide (Chrom AR HPLC Grade -
 Mallinckrodt)
- Pullulan Molecular Weight Standards - Showa
 Denko (ex Edward Instruments)

30 HPLC Mobile Phase - DMSO:DMF (20:80)

SAMPLE PREPARATION:

Standards

- (1) The pullulan molecular weight standards need to be weighed into the screw capped test tubes in the following manner:

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- Tube 1 - 5.0mg each of P800, P100, P10 and glucose
Tube 2 - 7.0mg each of P400, P50 and P5
Tube 3 - 7.0mg each of P200, P20 and maltotriose.
- 5 (2) Add DMSO (4mls) to each tube and tightly seal it.
 (3) heat the tubes in the boiling water bath for 5 minutes to dissolve the pullulan.
 (4) Remove and cool the test tube to room temperature.
- 10 (5) Add DMF (16mls) and mix well.
 (6) Place 3 x 1.5ml aliquots into microcentrifuge tubes and centrifuge at 14000rpm for 10 minutes.
 (7) Remove the top 1ml of solution from each centrifuge tube and place in a WISP vial.
- 15 Samples
 (1) Accurately weight the sample (50.0mg) into a screw capped test tube.
 (2) Add DMSO (10mls).
 (3) Heat in a boiling water bath for 60 minutes.
- 20 (4) Remove and cool the test tube to room temperature.
 (5) Add DMF (40mls) and mix well.
 (6) Place 3 x 1.5ml aliquots into microcentrifuge tubes and centrifuge at 14000rpm for 10 minutes.
- 25 (7) Remove the top\1ml of solution from each centrifuge tube and place in a WISP vial.
- HPLC Preparation
30 (1) Prior to fitting the column, pump water (100mls) through the HPLC.
 (2) Prepare the mobile phase and pump 50mls through the HPLC. Ensure that the WISP is purged during this stage.
 (3) Adjust the flow rate of 0.2ml/minute and connect the column.
 (4) Allow the column to equilibrate overnight.

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- (5) Prior to the injection of samples, purge the WISP and then gradually increase the flow rate to 1.5mls/minute.
- (6) Set the column heater to 25°C.
- 5 (7) Inject the standards and samples ~ 100µl injection volume.
- (8) After samples have been analysed turn the column heater off and reduce the flow rate of 0.2mls/minute.
- 10 (9) Disconnect the column.
- (10) Wash the system with water overnight at 0.5mls/minute.
- (11) Wash the system with methanol (200mls).

Viscographs have also been prepared comparing maize starch from Code 008 (designated Gelose 80) with Gelose 50 and Gelose 70. Figure 2 shows the viscosity profile under alkaline conditions whilst Figure 3 shows the viscosity profile in water.

Maize Starch

20 The maize starch of the first aspect of this invention having an amylose content of more than 80% may be used in a variety of compositions known in the art. The usefulness of the starch is believed to be a result of the higher content of more linear molecules. This seems 25 to impart physical properties which tend towards those of conventionally used synthetic plastics materials. Consequently, films formed from the starch of the invention have higher tensile strengths and are good oxygen barriers. The starch is also easier to process on 30 existing synthetic plastics materials equipment such as blow moulding and injection moulding machines.

Furthermore, this starch may be physically modified or chemically modified to produce a variety of derivatives well known in the art. These starches may also be used in 35 a variety of compositions.

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Finally, this starch may also be used in processes and compositions requiring the starch to be destructureized within the meaning of that term defined in EP0118240.

- Some non-limiting examples of compositions in which
- 5 the maize starch of this invention in all of its forms, could be used include:
1. Corrugating adhesives.
 2. Sausage skins.
 3. Confectionery.
 - 10 4. Other food compositions where the enhanced gel strength of the starch would be advantageous.
 5. Films, either alone or laminated with polymers such as ethylenevinylalcohol to achieve both gas and water barrier properties.
 - 15 6. Biodegradable and controlled release matrices and methods for forming and using these matrices as disclosed in PCT/AU90/00422, the contents of which is incorporated herein by way of reference.
 7. Shaped articles, processes for forming shaped
 - 20 articles and methods for using shaped articles as disclosed in PCT/AU90/00237, the contents of which is incorporated herein by way of reference.
 8. Coextrusions with synthetic polymers.
 9. Intermediate products such as pellets and rods,
 - 25 formed for example by extrusion, and including combinations of starch with one or more natural or synthetic polymers, plasticizers, colourants and other additives.
 10. Other blends of starch with natural or synthetic polymers to obtain enhanced structural properties.

Starch Fractions

The starches of the sixth and seventh aspects of this invention may originate from a number of sources including cereals such as maize, barley, wheat and legumes, providing

35 that the starch content of such sources is high in amylose.

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To fractionate the starch granules, there are a number of methods known in the art including dry powder sieving, hydrocyclone classification, air classification and differential sedimentation. A person skilled in the 5 art would be readily able to choose an appropriate method depending on the source material and other relevant factors.

Although the size fraction of enhanced dietary fibre and/or resistant starch may vary, the example that follows 10 describes the work that was done by the present inventors in relation to a maize starch sample. Based on this disclosure, a person skilled in the art could readily repeat this work using other starch sources to identify an appropriate fraction.

15 Once the starch has been appropriately fractionated, the fractions having enhanced dietary fibre and/or resistant starch content may be processed to obtain starch having further increased dietary fibre and/or resistant starch content using entirely conventional methods well 20 known in the art. An example of the fractionation will now be described.

Fractionation of Maize Starch by Granule Size

A high amylose maize starch - High Amylose 80(10/91) was fractionated into seven subsamples based on granule 25 size using the aqueous differential sedimentation procedure described by Cluskey et al (1980). This method was chosen since it minimised damage to the starch, did not introduce any residues and it was indicated that exposure of the starch granules to distilled water for 30 long periods of time did not affect their integrity. Each subsample was weighed, measured for average granule size and the apparent amylose content, total dietary fibre and resistant starch determined. Each starch sample (60 grams) was separated into the seven fractions which 35 were freeze-dried and weighed on a Mettler PE 3600 top pan

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balance. A scanning electron microscope was used to visually check the uniformity of the size distribution of the granules in each fraction.

- Each fractionated starch sample was analysed for
5 granule size according to the method described below.
Apparent amylose content was determined using the method
described above. Dietary fibre and resistant starch
(McCleary et al) were determined using the methods
disclosed in co-pending application PL6537.
- 10 Granule size was determined using a Malvern Master
Sizer which utilises a He-Ne laser (632.8nm) with a
maximum output of 5mW CW. In this method a starch slurry
was made using approximately 15mL of distilled water in a
50mL beaker. The slurry was sonicated for 4 minutes. The
15 slurry was then introduced into the stirred cell and the
obscuration value adjusted using distilled water to 0.20.
The slurry was allowed to stir for a further 2 minutes
before readings were taken. Four readings were taken for
each sample in order to check the stability of the
20 readings being obtained.
- Results
- In Table 1 set out below, there is shown the results
(the average of two separate fractionations, together with
the range of analytical results) obtained for each of
25 seven particle size fractions. These results are
graphically presented in Fig.4, from which it is
particularly evident that the level of resistant starch
and dietary fibre is significantly increased between the
second and fifth fractions, ie, 10.2-7.6 microns. Thus,
30 if those starch fractions were to be segregated from the
original starch sample, only 46.9% of the solids would
need to be removed to produce a fraction in which the
resistant starch was increased by 36% and dietary fibre by
24%.
- 35 Although the starch fractions of the invention are

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TABLE 1

Fractionation of High Amylose 80 (10/91) Maize Starch by Granule Size

	Amount in Fraction (g) dsb	Average Granule Size (microns)	Apparent Amylose Content (%) dsb	Total Dietary Fibre (%) dsb	Resistant Starch (%) dsb
High Amylose 80 - 10/91	100.00	10.0	85	33.4	18.1
Fraction 1	35.6 ± 1.1	12.3 ± 0.5	80 ± 0	31.4 ± 1.5	17.7
Fraction 2	15.0 ± 2.6	10.2 ± 0.1	83 ± 1	38.3 ± 2.0	16.4
Fraction 3	13.0 ± 1.1	9.1 ± 0.2	85.5 ± 0.5	41.3 ± 0.3	22.8
Fraction 4	14.9 ± 1.0	8.3 ± 0.1	85.5 ± 0.5	39.4 ± 4.1	24.5
Fraction 5	10.2 ± 1.6	7.6 ± 0.1	88.5 ± 0.5	37.2 ± 1.3	18.9
Fraction 6	7.0 ± 1.6	7.2 ± 0.1	89.5 ± 0.5	31.3 ± 2.4	21.7
Fraction 7	4.3 ± 2.7	6.8 ± 0.2	89	28.1	10.1

- 17 -

high in dietary fibre and/or resistant starch, it should also be appreciated that another important property is that these fractions are "naturally" derived. This arises out of the fact that the fractions are prepared using a physical means of separation. No chemical or other treatments are required in order to produce starch fractions having a high dietary fibre and/or resistant starch content. Such a property is of particular importance in food applications in that no regulatory approval would be required in order to incorporate such materials in food compositions.

The person skilled in the art will readily appreciate that the starch fractions of the invention having the enhanced dietary fibre and/or resistant starch content may be used in a variety of food compositions. Such uses are disclosed, for example, in co-pending application No PL6537.

Whilst it is not as yet known why the fractions of the invention have enhanced dietary fibre and/or resistant starch content, it will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made to the invention as described without departing from the spirit or scope of the invention as broadly described. Accordingly, the Example based on a sample of high amylose maize starch is to be considered in all respects as illustrative and not restrictive.

The person skilled in the art will readily appreciate that the maize starch of the invention both in its native form, and the other forms mentioned above will have many applications additional to those mentioned.

It will also be appreciated by those skilled in the art that numerous variations and modifications may be made to this invention without departing from the spirit or scope thereof as broadly described.

{ 8 }

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CLAIMS:

1. A hybrid maize seed capable of producing a starch having an amylose content of more than 80%.
2. A hybrid maize seed as in claim 1 obtained from a cross between any of the parental lines selected from the group consisting of G112, G113, G116, G117, G118, G119W, G120, G121, G122, G125W, G126, G128, G129, G135W, G136W, G138W, G139W, G140W and G144, said hybrid maize seed yielding a starch having an amylose content of more than 80%.
3. A hybrid maize seed as in claim 2 selected from the group consisting of the following crosses: G117 x G116, G116 x G122, G118 x G122, G120 x G122, G112 x G120, G122 x G140, G128 x G129, G140 x G121, G140 x G144, G139W x G136W and G121 x G116.
4. A hybrid maize seed as in any one of claims 1 to 3 wherein the seed yields a starch having an amylose content of 85.0% or more.
5. A hybrid maize seed as in claim 4 wherein the seed yields a starch having an amylose content of 90.1% or more.
6. A hybrid maize seed as in claim 5 wherein the seed yields a starch having an amylose content of 94.8% or more.
7. A hybrid maize seed as in claim 3 deposited as ATCC 75182.
8. A maize starch having an amylose content of more than 80%, physically or chemically modified derivatives thereof, and destructureized and non-structureized forms thereof.
9. A maize starch as in claim 8 having an amylose content of 85.0% or more.
10. A maize starch as in claim 9 having an amylose content of 90.1% or more.
11. A maize starch as in claim 10 having an amylose content of 94.8% or more.
12. A composition including a maize starch selected from

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- 19 -

the group consisting of maize starch having an amylose content of more than 80%, physically or chemically modified derivatives thereof and destructureized and non-structureized forms thereof.

- 5 13. A composition as in claim 12 wherein the maize starch has an amylose content of 85.0% or more.
14. A composition as in claim 13 wherein the maize starch has an amylose content of 90.1% or more.
15. A composition as in claim 14 wherein the maize starch
10 has an amylose content of 94.8% or more.
16. A starch fraction of enhanced dietary fibre and/or resistant starch content comprising a high amylose starch, the amylose content of which is 50% or more, which has been fractionated according to granule size to yield a
- 15 fraction which is characterised by a dietary fibre and/or resistant starch content which is greater than said high amylose starch.
17. A starch fraction as in claim 16 wherein the high amylose starch is selected from the group consisting of
- 20 maize, barley, wheat and legumes.
18. A starch fraction as in claim 16 or claim 17 wherein the amylose content of the high amylose starch is 70% or more, preferably 80% or more.
19. A starch fraction as in claim 18 wherein the amylose
25 content of the high amylose starch is 85% or more, preferably 90% or more.
20. A starch fraction as in any one of claims 16 to 19 wherein the fractionation is by dry powder sieving, hydrocyclone classification, air classification or
- 30 differential sedimentation.
21. A starch fraction as in any one of claims 16 to 20 wherein the dietary fibre content of the fraction is increased by about 24% or more and the resistant starch content of the fraction is increased by about 36% or more
- 35 over the high amylose starches.

WO 94/03049

PCT/AU93/00389

- 20 -

- ~~22. A starch fraction as in any one of claims 16 to 21
wherein the average granule size of the fraction is from
about 10.2 to 7.6 microns.~~
- ~~23. A food composition including a starch fraction as
5 claimed in any one of claims 16 to 22.~~

Add181>
Add182>
Add183>

✓ Add184

✓ 621777-32849680

A59

Docket No.: 1451-007B

#3/PraSmot
3
CQueen
PATENT 3/24/98

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of :
Kenneth J. McNAUGHT et al. :
Rule 60 Divisional of : Group Art Unit:
Serial No. 08/374,645 :
Filed: November 12, 1997 : Examiner:
For: HIGH AMYLOSE STARCH AND RESISTANT STARCH FRACTIONS

PRELIMINARY AMENDMENT

(1) Honorable Commissioner of
Patents and Trademarks
Washington, D. C. 20231

(2) Sir:

(3) Prior to examination of the above-referenced application,
please amend the application as follows:

IN THE ABSTRACT:

(4) Please insert the enclosed new page 21 to provide an Abstract
of Disclosure for the application.

IN THE CLAIMS:

Please cancel claim 8 and replace with the following new claim

24.

~~24.~~ A maize starch selected from the group consisting of
maize starch having an amylose content of more than 80%, physically

Rule 60 Divisional of
Serial No. 08/374,645

B3
or chemically modified derivatives of maize starch having an amylose content of more than 80%, destructureized maize starch having an amylose content of more than 80%, and non-destructurized maize starch having an amylose content of more than 80%.)

Claim 9, line 1, change "8" to --24--.

Please cancel claim 12 and replace with the following new claim 25.

B3
~~C~~ 25. A composition comprising a maize starch selected from the group consisting of maize starch having an amylose content of more than 80%, physically or chemically modified derivatives of maize starch having an amylose content of more than 80%, destructureized maize starch having an amylose content of more than 80%, and non-destructurized maize starch having an amylose content of more than 80%.)

Claim 13, line 1, change "12" to --25--.

REMARKS

Entry of this Preliminary Amendment is respectfully requested. Applicants note that claim 8 is rewritten as new claim 24 and claim 12 is rewritten as new claim 25. It is requested that the Examiner renumber the claims in the application to incorporate the changes from this amendment.

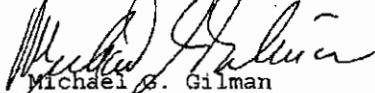
Rule 60 Divisional of
Serial No. 08/374,645

In parent application Serial No. 08/374,645, it was determined that an Abstract be presented for the application. Accordingly, presented herewith on separate page 21, is an Abstract for this application.

Please charge any shortage in fees due in connection with the filing of this paper to Deposit Account 12-2237 and please credit any excess fees to such deposit account.

Respectfully submitted,

LOWE, PRICE, LEBLANC & BECKER


Michael S. Gilman
Registration No. 19,114

99 Canal Center Plaza, Suite 300
Alexandria, Virginia 22314
(703) 684-1111 MGG:amz
Date: November 12, 1997
Facsimile: 703-684-1124

21

HIGH AMYLOSE STARCH AND RESISTANT STARCH FRACTIONS

Abstract of the Disclosure

B1 Starch, particularly maize starch, having an amylose content of more than 80% w/w, including physically or chemically modified derivatives thereof, and destructurized and non-destructurized forms thereof. Also, disclosed are hybrid maize seeds capable of producing a starch having an amylose content of more than 80%. Also disclosed are starch fractions of enhanced dietary fiber and/or resistant starch content.

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A63



**UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office**

Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
007/507,620	10/7/02/02	R. WELCH	100-111-0000

POSTAL PATENT EXAMINER & OFFICER
229 CANAL CENTER PLAZA
SUITE 1000
CHARLESTON, SC 29403

007/507,620

EXAMINER

(RODOLFO PEREZ)

ART UNIT

PAPER NUMBER

17600

DATE MAILED: 07/16/03

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No.	Applicant(s)
	08/967,826	McNaught et al
	Examiner David M. Brunsman	Group Art Unit 1755
<p><input checked="" type="checkbox"/> Responsive to communication(s) filed on <u>26 May 1998</u></p> <p><input type="checkbox"/> This action is FINAL.</p> <p><input type="checkbox"/> Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under <i>Ex parte Quayle</i>, 1935 C.D. 11; 453 D.G. 213.</p> <p>A shortened statutory period for response to this action is set to expire <u>three</u> month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).</p> <p>Disposition of Claims</p> <p><input checked="" type="checkbox"/> Claim(s) <u>9-11, 13-15, 24, and 25</u> is/are pending in the application.</p> <p>Of the above, claim(s) _____ is/are withdrawn from consideration.</p> <p><input type="checkbox"/> Claim(s) _____ is/are allowed.</p> <p><input checked="" type="checkbox"/> Claim(s) <u>9, 11, 13, 15, 24, and 25</u> is/are rejected.</p> <p><input checked="" type="checkbox"/> Claim(s) <u>10 and 14</u> is/are objected to.</p> <p><input type="checkbox"/> Claims _____ are subject to restriction or election requirement.</p> <p>Application Papers</p> <p><input type="checkbox"/> See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.</p> <p><input type="checkbox"/> The drawing(s) filed on _____ is/are objected to by the Examiner.</p> <p><input type="checkbox"/> The proposed drawing correction, filed on _____ is <input type="checkbox"/> approved <input type="checkbox"/> disapproved.</p> <p><input type="checkbox"/> The specification is objected to by the Examiner.</p> <p><input type="checkbox"/> The oath or declaration is objected to by the Examiner.</p> <p>Priority under 35 U.S.C. § 119</p> <p><input type="checkbox"/> Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(e)-(d).</p> <p><input type="checkbox"/> All <input type="checkbox"/> Some* <input type="checkbox"/> None of the CERTIFIED copies of the priority documents have been received.</p> <p><input type="checkbox"/> received in Application No. (Series Code/Serial Number) _____.</p> <p><input type="checkbox"/> received in this national stage application from the International Bureau (PCT Rule 17.2(a)).</p> <p>*Certified copies not received: _____</p> <p><input type="checkbox"/> Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).</p> <p>Attachment(s)</p> <p><input checked="" type="checkbox"/> Notice of References Cited, PTO-892</p> <p><input type="checkbox"/> Information Disclosure Statement(s), PTO-1449, Paper No(s). _____</p> <p><input type="checkbox"/> Interview Summary, PTO-413</p> <p><input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review, PTO-948</p> <p><input type="checkbox"/> Notice of Informal Patent Application, PTO-152</p>		

-- SEE OFFICE ACTION ON THE FOLLOWING PAGES --

Serial Number: 08/967826

Page 2

Art Unit: 1108

AM Claims 19 and 25^M are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

AM Claims 19 and 24 are allowable over the prior art of record and will be subject to analysis for interference proceedings pending disposition of the remaining claims.

"HIGH-AMYLOSE CORN STARCH: ITS PRODUCTION, PROPERTIES, AND USES", R.F. Senti, Chapter XXI of Starch Chemistry and Technology, Whistler, R.L. and Paschall, E.F. is representative of the large body of prior art teaching starch having up to 85% apparent amylose.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 24, 9, 25, and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by

Senti.

Much of the prior art relies on amylose determination based on iodine affinity such as colorimetric, as in the instant application, or potentiometric. The prior art measures this "apparent" amylose by iodine affinity also. Interpreting the claims in light of the specification, the instant claims must be read as "...maize starch having an amylose content of more than 80%, as

Serial Number: 08/967826

Page 3

Art Unit: 1108

measured by colorimetric iodine analysis...". Senti teaches maize starch containing 85% amylose as measured by colorimetric iodine affinity analysis and gel composition, made therewith.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371 of this title before the invention thereof by the applicant for patent.

Claims 11 and 15 are rejected under 35 U.S.C. 102(e) as being anticipated by US 5,300,145.

The reference includes low amylopectin starches containing up to 99% amylose and "low molecular weight amylose." The basis in the instant application for the limitation at least 94.8% amylose is not found in priority application PL 3894.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David M. Brunsman whose telephone number is (703) 308-3454. The examiner can normally be reached on Mondays, Tuesdays, Thursdays and Fridays from 6:30 am to 5:00 pm eastern time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Bell, can be reached on (703) 308-3823. The fax phone number for this Group is (703) 305-3599.

Serial Number: 08/967826

Page 4

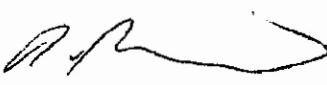
Art Unit: 1108

Communications via Internet e-mail regarding this application, other than those under 35 U.S.C. 132 or which otherwise require a signature, may be used by the applicant and should be addressed to [mark.bell@uspto.gov].

All Internet e-mail communications will be made of record in the application file. PTO employees do not engage in Internet communications where there exists a possibility that sensitive information could be identified or exchanged unless the record includes a properly signed express waiver of the confidentiality requirements of 35 U.S.C. 122. This is more clearly set forth in the Interim Internet Usage Policy published in the Official Gazette of the Patent and Trademark on February 25, 1997 at 1195 OG 89.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0661.

DMBrunsman
July 13, 1998


David M. Brunsman
Primary Examiner
Group 1755

<i>Notice of References Cited</i>			Application No. 08/967,826	Applicant(s) McNaught et al		
			Examiner David M. Brusman	Group Art Unit 1765		
			Page 1 of 1			
U.S. PATENT DOCUMENTS						
	DOCUMENT NO.	DATE	NAME		CLASS	SUBCLASS
A						
B						
C						
D						
E						
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FOREIGN PATENT DOCUMENTS						
	DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUBCLASS
N						
O						
P						
Q						
R						
S						
T						
NON-PATENT DOCUMENTS						
	DOCUMENT (including Author, Title, Source, and Pertinent Pages)				DATE	
U	Santi, "High-Amylose Corn Starch: its production, properties and use"				1967	
V						
W						
X						

X no month available

A71

10

Docket No.: 50179-026 (1451-007B)

R/C
9/23/98
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of :
Kenneth J. McNAUGHT et al. :
Serial No. 08/967,826 : Group Art Unit: 1755
Filed: November 12, 1997 : Examiner: D. Brunsman
For: HIGH AMYLOSE STARCH AND RESISTANT STARCH FRACTIONS

RESPONSE TO OFFICIAL ACTION

Honorable Assistant Commissioner
for Patents and Trademarks
Washington, D. C. 20231

Sir:

This is in response to the Official Action dated July 14,
1998, in this application.

Please amend the application as follows:

IN THE CLAIMS:

Please cancel claims 5, 10, 13 and 14 from the application.

Please amend claims 11 and 15 to read as follows:

21. (Amended) A maize starch as in claim [10] *24* having an
apparent amylose content of 95.7% [94.8%] or more.

Serial No. 08/967,826

C2 15. (Amended) A composition as in claim [14] ~~25~~ wherein the maize starch has an apparent amylose content of 95.7% [94.8%] or more.

Please amend claims 24 and 25 to read as follows:

C3 24. (Amended) A maize starch selected from the group consisting of maize starch having an apparent amylose content of more than 90.1% [80%], physically or chemically modified derivatives of maize starch having an apparent amylose content of more than 90.1% [80%], destructurized maize starch having an apparent amylose content of more than 90.1% [80%], and non-destructurized maize starch having an apparent amylose content of more than 90.1% [80%].

C4 25. (Amended) A composition comprising a maize starch selected from the group consisting of maize starch having an apparent amylose content of more than 90.1% [80%], physically or chemically modified derivatives of maize starch having an apparent amylose content of more than 90.1% [80%], destructurized maize starch having an apparent amylose content of more than 80%, and non-destructurized maize starch having an apparent amylose content of more than 90.1% [80%].

Serial No. 08/967,826

Please add the following new claim:

26. A maize starch as in claim 24 having an apparent amylose content of 93.0%.

REMARKS

The Official Action of July 14, 1998 has been carefully considered. Accordingly, the amendments to the claims of this application, taken with the following remarks, are believed sufficient to place the application in condition for allowance. By this Amendment, claims 9, 10, 13 and 14 are cancelled, and independent claims 24 and 25 have been revised to indicate that the maize starch has an apparent amylose content of more than 90.1% with support from original claim 10 and in the application at page 9, lines 31-33. A minimum 90.1% value is also found in Australian priority application No. PL3894, at page 7, line 15. In addition, claims 11 and 15 have been amended to recite an apparent amylose content of 95.7% rather than 94.8%. Support for this value may be found in the table on page 9 of the specification and in the same table on page 10 of the Australian application PL3894. In addition, specific claim 26 has been added to cover a specific starches described in these tables of an apparent amylose content of 93.0%. Support for the term "apparent" amylose content may be found at page 5, line 1, and elsewhere in the disclosure.

Serial No. 08/967,826

Therefore, since all the amendments are fully supported by the specification, entry is requested.

In the Official Action, claims 11 and 15 were objected to as being dependent upon a rejected base claim but would be allowable if rewritten in independent form. It is believed that the Examiner intended that this objection pertain to claims 10 and 14 because claims 11 and 15 are rejected on page 3 of the Action, as anticipated by U.S. Patent No. 5,300,145 on the ground that support for the limitation of 94.8% is not found in priority application PL3894. Claims 10 and 14 have been cancelled and the 90.1% limitation has been inserted into independent claims 24 and 25 to make those claims allowable.

In addition, claims 11 and 15, which were rejected as anticipated by U.S. Patent No. 5,300,145 have been amended to recite that the amylose content is 95.7% rather than 94.8%. Support for the value of 95.7% is found in the table on page 9 of the specification and in the corresponding table in Australian priority application No. PL3894.

Broad claims 24, 9, 25 and 13 were rejected under 35 U.S.C. §102(b) as anticipated by the reference to Senti. The Examiner did not provide a copy of the reference but indicated that it was representative of a large body of prior art teaching starch having up to 85% apparent amylose. In order to avoid this reference, Applicants have amended the main claims in this application to

Serial No. 08/967,826

indicate that the minimum starch amylose content in the starch is 90.1% as in original claim 10 and 14, which are believed free of the art. Therefore, it is believed that the enclosed amendments and above remarks are sufficient to place all claims in this application in condition for allowance.

Since the claims are believed to be in condition for allowance, Applicants hereby renew the Request for Interference as originally filed May 26, 1998. As pointed out in that prior request, Applicants request that an interference be declared between this application and U.S. Patent No. 5,300,145 which has a filing date of August 28, 1992. This application is a division of prior pending allowed application Serial No. 08/374,645, filed April 27, 1995, which latter application is a section 371 application of PCT/AU93/00389 filed July 30, 1993. The PCT application claims priority to Australian application No. PL3894 filed July 31, 1992 and Serial No. PL7266 filed February 12, 1993 in Australia. It is submitted that Applicants are entitled to the benefit of the filing date of Australian priority application No. PL3894 filed July 31, 1992, for all pending claims which filing date antedates the filing date of U.S. Patent No. 5,300,145. Accordingly, in any interference, Applicants should be indicated as the senior party. It is therefore requested that an interference be declared with the following proposed count:

Serial No. 08/967,826

Proposed Count

A substantially pure starch extracted from a plant source having an amylose extender genotype, the starch comprising at least 75% amylose determined by butanol fractionation/exclusion chromatography measurement,

or

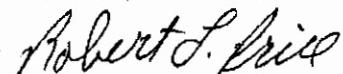
a maize starch selected from the group consisting of maize starch having an apparent amylose content of more than 90.1%, physically or chemically modified derivatives of maize starch having an apparent amylose content of more than 90.1%, destructurized maize starch having an apparent amylose content of more than 90.1%, and non-destructurized maize starch having an apparent amylose content of more than 90.1%.

This proposed count covers the subject matter of claim 6 of U.S. Patent 5,300,145 or claim 24 of this application. Claims 1-20 of U.S. Patent 5,300,145 are considered to correspond to the proposed count. Claims 11, 15 and 24-26 of this application are considered to correspond to the proposed count.

It is believed that all claims in the application are in now in condition for allowance and declaration of an interference is in order. Accordingly, allowance and declaration of the interference are requested.

Respectfully submitted,

MCDERMOTT, WILL & EMERY



Robert L. Price
Registration No. 22,685

99 Canal Center Plaza, Suite 300
Alexandria, Virginia 22314
(202) 756-8600 RLP;brca
Date: September 22, 1998
Facsimile: 202-756-8699

1755

Docket No.: 1451-007B (S0179-026)PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Kenneth J. McNAUGHT et al.

Serial No. 08/967,826

Filed: November 12, 1997

For: HIGH AMYLOSE STARCH AND RESISTANT STARCH FRACTIONS



Group Art Unit: 1302

Examiner: D. Brunstman

THE COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D. C. 20231

98 SEP 23 AM 7:33
RECEIVED
GROUP 1300

Dear Sir:

Transmitted herewith is an Response in the above identified application.
 No additional fee is required.
 Also attached:

The fee has been calculated as shown below:

	NO. OF CLAIMS	HIGHEST PREVIOUSLY PAID FOR	EXTRA CLAIMS	RATE	FEE
Total Claims	5	20	0	x \$22 =	0
Independent Claims	2	3	0	x \$82 =	0
If multiple claims newly presented, add \$270.00					
Fee for extension of time					
TOTAL FEE DUE					0

Please charge my Deposit Account No. 500417 in the amount of \$. An additional copy of this transmittal sheet is submitted herewith.

The Commissioner is hereby authorized to charge payment of any fees associated with this communication or credit any overpayment, to Deposit Account No. 500417, including any filing fees under 37 CFR 1.16 for presentation of extra claims and any patent application processing fees under 37 CFR 1.17.

Respectfully submitted,

McDERMOTT, WILL & EMERY

Robert L. Price
Registration No. 22,685

99 Canal Center Plaza, Suite 300
Alexandria, Virginia 22314
(202) 756-8600 RLP:brca
Date: September 22, 1998
Facsimile: 202-756-8699

A79



UNITED STATES DEPARTMENT OF COMMERCE

Patent and Trademark Office

Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

R.F.

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
08/982, 826	11/12/97	MCNAUGHT	K 1451-007B

MCDERMOTT WILL & EMERY 600 13TH STREET N.W. WASHINGTON DC 20005	IM52/1009	EXAMINER
		BRUNSMAN, D
	ART UNIT	PAPER NUMBER
	1755	13
	DATE MAILED: 10/09/01	

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No.	Applicant(s)	
	08/967,826	MCNAUGHT ET AL.	
	Examiner David M Brunsman	Art Unit 1755	
<i>-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --</i>			
Period for Reply			
A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.			
<ul style="list-style-type: none"> - Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication. - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely. - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication. - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). - Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b). 			
Status			
<p>1)<input checked="" type="checkbox"/> Responsive to communication(s) filed on <u>22 September 1998</u>.</p> <p>2a)<input type="checkbox"/> This action is FINAL. 2b)<input checked="" type="checkbox"/> This action is non-final.</p> <p>3)<input type="checkbox"/> Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under <i>Ex parte Quayle</i>, 1935 C.D. 11, 453 O.G. 213.</p>			
Disposition of Claims			
<p>4)<input checked="" type="checkbox"/> Claim(s) <u>11,15 and 24-26</u> is/are pending in the application.</p> <p>4a) Of the above claim(s) _____ is/are withdrawn from consideration.</p> <p>5)<input type="checkbox"/> Claim(s) _____ is/are allowed.</p> <p>6)<input checked="" type="checkbox"/> Claim(s) <u>11,15 and 24-26</u> is/are rejected.</p> <p>7)<input type="checkbox"/> Claim(s) _____ is/are objected to.</p> <p>8)<input type="checkbox"/> Claim(s) _____ are subject to restriction and/or election requirement.</p>			
Application Papers			
<p>9)<input type="checkbox"/> The specification is objected to by the Examiner.</p> <p>10)<input type="checkbox"/> The drawing(s) filed on _____ is/are: a)<input type="checkbox"/> accepted or b)<input type="checkbox"/> objected to by the Examiner. <small>Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).</small></p> <p>11)<input type="checkbox"/> The proposed drawing correction filed on _____ is: a)<input type="checkbox"/> approved b)<input type="checkbox"/> disapproved by the Examiner. <small>If approved, corrected drawings are required in reply to this Office action.</small></p> <p>12)<input type="checkbox"/> The oath or declaration is objected to by the Examiner.</p>			
Priority under 35 U.S.C. §§ 119 and 120			
<p>13)<input checked="" type="checkbox"/> Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).</p> <p>a)<input checked="" type="checkbox"/> All b)<input type="checkbox"/> Some * c)<input type="checkbox"/> None of: 1.<input type="checkbox"/> Certified copies of the priority documents have been received. 2.<input checked="" type="checkbox"/> Certified copies of the priority documents have been received in Application No. <u>08/374,845</u>. 3.<input type="checkbox"/> Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).</p> <p>* See the attached detailed Office action for a list of the certified copies not received.</p> <p>14)<input type="checkbox"/> Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application). a)<input type="checkbox"/> The translation of the foreign language provisional application has been received.</p> <p>15)<input checked="" type="checkbox"/> Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.</p>			
Attachment(s)			
1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-848) 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.		4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s) _____. 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) 6) <input type="checkbox"/> Other: _____.	

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A rejection based on double patenting of the "same invention" type finds its support in the language of 35 U.S.C. 101 which states that "whoever invents or discovers any new and useful process ... may obtain a patent therefor ..." (Emphasis added). Thus, the term "same invention," in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957); and *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the conflicting claims so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

Claims 24 and 25 are rejected under 35 U.S.C. 101 as claiming the same invention as that of claims 3 and 7 of prior U.S. Patent No. 5714600. This is a double patenting rejection. The terms "amylose content" as recited in the patent and "apparent amylose content" as recited in the instant application are defined alike.

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 11, 15 and 26 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 3, 4, 7, and 8 of U.S. Patent No. 5714600. Although the conflicting claims are not identical, they are not patentably distinct from each other because the ranges claimed overlap with that of the patent. As admitted in the instant

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specification, it has been desired in the art to maximize amylose content. It would have been obvious to one of ordinary skill in the art to select amylose contents greater than 93% or greater than 95.7% for that reason. The particular ranges are explicitly disclosed in the patent examples, see page 5, lines 10-20.

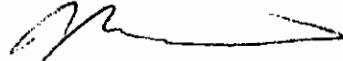
Any inquiry concerning this communication or earlier communications from the examiner should be directed to David M Brunsman whose telephone number is 703-308-3454. The examiner can normally be reached on M, Tu, Th, F (6:30-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Bell can be reached on 703-308-3823. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9049 for regular communications and 703-305-3599 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

David M Brunsman
Primary Examiner
Art Unit 1755

DMB
October 8, 2001



Notice of References Cited	Application/Control No.	Applicant(s)/Patent Under Reexamination: MCNAUGHT ET AL.	
	08/987,826 Examiner David M Brunsman	Art Unit 1755	Page 1 of 1

U.S. PATENT DOCUMENTS

*	Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification	
A	US-5714600	02-1998	McNaught et al	536	102
B	US-				
C	US-				
D	US-				
E	US-				
F	US-				
G	US-				
H	US-				
I	US-				
J	US-				
K	US-				
L	US-				
M	US-				

FOREIGN PATENT DOCUMENTS

*	Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
N					
O					
P					
Q					
R					
S					
T					

NON-PATENT DOCUMENTS

*	Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
U	
V	
W	
X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



Docket No.: 50179-026

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

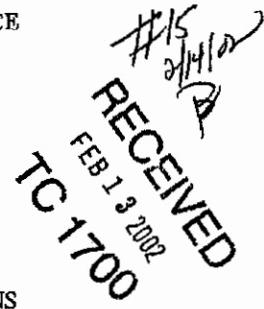
In re Application of

Kenneth J. MCNAUGHT, et al.

Serial No.: 08/967,826 Group Art Unit: 1302

Filed: November 12, 1997 Examiner: D. Brunsman

For: HIGH AMYLOSE STARCH AND RESISTANT STARCH FRACTIONS

RESPONSE TO OFFICIAL ACTIONCommissioner for Patents
Washington, DC 20231

Sir:

This is in response to the Official Action of October 9, 2001 in this application.

In the action, double patenting rejections were made over certain claims of applicants' parent U.S. Patent 5,714,600. In particular, claims 24 and 25 were rejected under 35 USC 101 as claiming the same invention as that of claims 3 and 7 of prior U.S. Patent 5,714,600 ('600 patent). In addition, claims 11, 15 and 26 were rejected under the judicially created doctrine of obviousness type double patenting over claims 3, 4, 7 and 8 of U.S. Patent 5,714,600. Reconsideration of these rejections is requested.

The Examiner has apparently made these rejections based on a misinterpretation of the Certificate of Correction issued in the applicants' parent '600 patent. In fact, claims 1-8 do not exist in the parent '600 patent as those claims were cancelled prior to issuance of the patent. However, the Patent Office failed to enter the appropriate amendment so that the patent was printed including claims 1-8 which in fact had been cancelled. One copy of the Certificate of Correction issued for the parent patent is enclosed. In that Certificate of Correction, the Examiner will note that the Certificate states that claims 9-

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11, 13-15, 24 and 25 of the application Serial No. 374,645 which issued as this patent had been cancelled. Accordingly, the final order of the claims in the '600 patent should be claims 16-29 which should be renumbered as claims 1-10. There is one error in the Certificate of Correction in that claim 17 should also be dependent on claim 1. The Certificate of Correction is somewhat confusing however because it refers to the original numbering of the claims from the pending application which subsequently became the '600 patent. Thus, application claim 16 is patent claim 9, application claim 17 is patent claim 10, and application claims 26-29 are claims 11-14 respectively, and application claims 20-23 are patent claims 15-18, respectively. Applicants will file a request for a further Certificate of Correction to clarify this matter.

Since all the double patenting rejections are based on the claims which were cancelled from the '600 patent, it is submitted that the rejection should be withdrawn and the claims found allowable.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

MCDERMOTT, WILL & EMERY

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Date: February 8, 2002
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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 5,714,600
DATED : February 3, 1998
INVENTOR(S) : Kenneth J. McNAUGHT et al

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

--Cancel claims 9-11, 13-15, 24 and 25--.

The Final Order of the claims should be:

1. 16
2. 17
3. 20 depends 1
4. 21 depends 2
5. 22 depends 1
6. 23 depends 1
7. 26 depends 2
8. 27 depends 7
9. 28 depends 8
10. 29 depends 9

Signed and Sealed this
Sixteenth Day of June, 1998


Attest:

Bruce Lehman
BRUCE LEHMAN
Commissioner of Patents and Trademarks